NORTH CAROLINA DIVISION OF AIR QUALITY

Application Review

Issue Date:

Region: Winston-Salem Regional Office
County: Guilford
NC Facility ID: 4101022
Inspector's Name: Taylor Hartsfield
Date of Last Inspection: 06/06/2018
Compliance Code: 3 / Compliance - inspection

Facility Data

Applicant (Facility's Name): Qorvo US, Inc.

Facility Address:
Qorvo US, Inc.
7628 Thorndike Road
Greensboro, NC 27409

SIC: 3674 / Semiconductors & Related Devices
NAICS: 334413 / Semiconductor and Related Device Manufacturing

Facility Classification: Before: Title V **After:** Title V
Fee Classification: Before: Title V **After:** Title V

Permit Applicability (this application only)

SIP: 02D .0503, .0515, .0516, .0521, .0524, .0541, .1100, .1806
NSPS: Dc, IIII
NESHAP: ZZZZ, BBBBB, JJJJJJ, WWWWWW
PSD: N/A
PSD Avoidance: Yes
NC Toxics: Yes
112(r): N/A
Other:

Contact Data

Facility Contact	Authorized Contact	Technical Contact
Erich Burke Senior Environmental Engineer (336) 931-8042 7628 Thorndike Road Greensboro, NC 27409	Steve Bean Director of Facilities (336) 931-8087 7628 Thorndike Road Greensboro, NC 27409+9421	Erich Burke Senior Environmental Engineer (336) 931-8042 7628 Thorndike Road Greensboro, NC 27409

Application Data

Application Number: 4101022.19A
Date Received: 02/01/2019
Application Type: Renewal
Application Schedule: TV-Renewal

Existing Permit Data
Existing Permit Number: 08409/T18
Existing Permit Issue Date: 03/06/2018
Existing Permit Expiration Date: 11/30/2019

Total Actual emissions in TONS/YEAR:

CY	SO2	NOX	VOC	CO	PM10	Total HAP	Largest HAP
2017	0.0100	5.44	72.91	2.83	0.1200	1.51	1.07 [Chlorine]
2016	0.0100	6.44	62.89	3.01	0.1500	1.57	1.15 [Chlorine]
2015	0.0100	5.86	36.38	2.82	0.4200	1.64	1.12 [Chlorine]
2014	0.1800	5.92	29.58	3.16	0.4300	2.19	1.56 [Chlorine]
2013	0.1200	4.74	64.35	2.77	0.3400	2.09	1.38 [Chlorine]

Review Engineer: Eric Crump

Review Engineer's Signature: **Date:**

Comments / Recommendations:
Issue 08409/T19
Permit Issue Date:
Permit Expiration Date:

1. Purpose of Application

Qorvo US, Inc. (Qorvo) currently owns and operates semiconductor manufacturing and associated facilities at 7914 Piedmont Triad Parkway, 7908 Piedmont Triad Parkway, 7628 Thorndike Road, 7907 Piedmont Triad Parkway, and 8220 Piedmont Triad Parkway in Greensboro, Guilford County, North Carolina. The facility operates under Title V permit No. 08409T18 with an expiration date of November 30, 2019. Qorvo has applied for renewal of their facility's air quality permit. The renewal application No. 4101022.19A was received on February 1, 2019, at least nine months prior to the expiration date. Therefore, the existing permit shall not expire until the renewal permit has been issued or denied. All terms and conditions of the existing permit shall remain in effect until the renewal permit has been issued or denied.

Through permit application No. 4101022.19A**,** Qorvo requested the following changes to the permit:

- Add a laser ablation tool (ID No. I-LA) to the insignificant activities list;
- Remove the SO_2 limit and associated recordkeeping and reporting condition (Special Condition 2.2 A.4) from the permit;
- Add three cooling towers to the insignificant activities list; and
- Add six natural gas-fired heaters (ID Nos. I-GFUH2 through I-GFUH7) to the insignificant activities list.

Facility Description

Qorvo currently operates out of the following sites, all located in Greensboro:

- 7907 Piedmont Triad Parkway: houses packaging lab operations and two natural gas-fired boilers. A third boiler for this site is in the permit, but has not yet been installed.
- 7908 Piedmont Triad Parkway: This building houses semiconductor production of six-inch wafers. There are two semiconductor manufacturing lines, conducting photolithography, metallization, etch and deposition, and testing in clean room environments. The building also contains the wafer dicing center, three natural gas/No. 2 fuel oil-fired boilers, and four No. 2 fuel oil-fired emergency generators.
- 7914 Piedmont Triad Parkway: Primarily used for testing and R&D, this building houses five natural gas-fired boilers, six natural gas-fired humidifiers, and two No. 2 fuel oil-fired emergency generators. Qorvo has added a microshield plating line project at the site, which includes an electrolytic copper/nickel plating line, an electroless copper plating line, a rack stripping line**,** and three natural gas-fired rise water evaporators.
- 8220 Piedmont Triad Parkway: houses four natural gas-fired humidifiers, a natural gas-fired area heater, and a 500 kW No. 2 fuel oil-fired emergency generator. The facility has a 20,000-gallon capacity diesel fuel storage tank.
- 7628 Thorndike Road: This is the headquarters building. It has a small No. 2 fuel oil-fired generator.

3. Application Chronology

December 29, 2014	Permit No. 08409T13 issued to RF Micro Devices, Inc.
September 15, 2015	Compliance inspection conducted by Taylor Hartsfield, Winston-Salem Regional Office (WSRO). Facility appeared to be operating in compliance with all permit requirements.
April 15, 2016	U.S. Environmental Protection Agency (EPA) issues "Guidance on Vacatur of RICE NESHAP and NSPS Provisions for Emergency Engines", regarding the court decision to vacate portions of 40 CFR part 60 subparts IIII and JJJJ, and 40 CFR part 63 subpart ZZZZ.

June 14, 2016	Compliance inspection conducted by Taylor Hartsfield, WSRO. Facility appeared to be operating in compliance with all permit requirements.
June 21, 2016	North Carolina Division of Air Quality (NC DAQ) acknowledges receipt of permit application from Qorvo (formerly known as RF Micro Devices, Inc.) requesting an ownership and name change for Permit No. 08409T13.
July 25, 2016	Permit No. 08409T14 issued to Qorvo.
August 30, 2016	Qorvo submits permit application to NC DAQ for a modification under 15A NCAC 02D .0501(d) to install a microshield plating line.
October 19, 2016	NC DAQ review of toxic dispersion modeling analysis confirms new maximum allowable facility-wide emission limits for toxic air pollutants (TAPs).
November 21, 2016	NC DAQ receives letter from Jim Schonover, Qorvo Director of Facilities requesting that the modification application be processed following 15A NCAC 02Q .0501(c)(2). Because this modification involves a significant change to existing monitoring and recordkeeping requirements it is considered a significant modification under 15A NCAC 02Q .0516.
December 2, 2016	Permit No. 08409T15 issued to Qorvo as a construction and operation permit.
January 6, 2017	NC DAQ acknowledges receipt of application from Qorvo to administratively amend Specific Condition 2.1 I.3.c (Compliance Requirements for 15A NCAC 02D .1111 – National Emission Standards for Hazardous Air Pollutants: Area Source Standards for Plating and Polishing Operations – Subpart WWWWWW) in Permit No. 08409T15.
January 13, 2017	Permit No. 08409T16 issued to Qorvo.
February 28, 2017	NC DAQ acknowledges receipt of application from Qorvo to administratively amend Specific Conditions 2.2 A.1 and 2.2 A.5, relating to state-only TAPs in Permit No. 08409T16.
April 24, 2017	Permit No. 08409T17 issued to Qorvo.
June 20, 2017	Compliance inspection conducted by Taylor Hartsfield and Mohammad Khan, WSRO. Facility appeared to be operating in compliance with all permit requirements.
November 27, 2017	Letter from Qorvo to WSRO designating Steven Bean as the new Responsible Official for the Qorvo facility.
December 18, 2017	NC DAQ acknowledges receipt of Title V update application from Qorvo on or before 12 months after commencing operation of the microshield plating line in accordance with Permit General Condition NN.1.
March 6, 2018	Permit No. 08409T18 issued to Qorvo.
February 27, 2018	NC DAQ receives applicability determination application from Qorvo seeking determination on the need of an air quality permit for a laser ablation tool to cut epoxy on circuit boards.
April 4, 2018	NC DAQ sends letter to Qorvo acknowledging receipt of applicability determination

	application (No. 3222) from Qorvo, and determining that an air quality permit is not required for the laser ablation tool. The tool should be considered an insignificant activity.
June 6, 2018	Compliance inspection conducted by Taylor Hartsfield and George Williams, WSRO. Facility appeared to be operating in compliance with all permit requirements.
February 1, 2019	NC DAQ acknowledges receipt of permit renewal application from Qorvo.
February 28, 2019	Compliance inspection conducted by Jim Hafner, WSRO. Facility appeared to be operating in compliance with all permit requirements.
May 15, 2019	Qorvo informs NC DAQ of their intent to replace control device ID No. CDEB3 (a constant stirred tank particulate abatement device) with a state-of-the-art compact packed bed Airgard scrubber. CDEB3 is not required to be operating to achieve compliance with any state or Federal air quality standard (per Air Permit 08409T18).
May 29, 2019	NC DAQ agrees to include the replacement of constant stirred tank particulate abatement device ID No. CDEB3 with a new compact packed bed scrubber (ID No. CDAG1) in the permit renewal.

4. Permit Modifications and Title V Equipment Editor (TVEE) Discussion

The following table summarizes changes to the Qorvo permit resulting from the permit renewal:

Page No.	Section	Description of Changes
Cover and throughout	---	• Updated all dates and permit revision numbers • Changed all citations of 15A NCAC 2D to 15A NCAC 02D • Changed all citations of 15A NCAC 2Q to 15A NCAC 02Q
Insignificant Activities List	---	• Added Source ID No. I-LA, Laser ablation tool • Added Source ID Nos. I-B1 through I-B3, natural gas-fired boilers, 3.5 mmBtu/hr heat input each • Added Source ID Nos. I-B4 through I-B8, natural gas-fired boilers, 1.56 mmBtu/hr heat input each • Added Source ID Nos. I-GFUH2 through I-GFUH7, natural gas-fired space heaters, 0.15 million Btu per hour heat input each • Added Source ID No. I-CTC, Two-cell cooling tower at 7914 Piedmont Triad Parkway • Added Source ID No. I-CTD Five-cell cooling tower at 7908 Piedmont Triad Parkway • Added Source ID No. I-CTM, Single-cell cooling tower at 8220 Piedmont Triad Parkway
3	1	Removed boilers ID Nos. B4 through B8 from table
4	1	Changed control device ID No. CDEB3 (parallel constant stirred tank particulate abatement device) to CDAG1 (small packed bed particulate scrubber)
5	1	Removed boilers ID Nos. B1 through B3 from table
6	2.1 A	Changed control device ID No. CDEB3 to CDAG1
6-7	2.1 A.1	Updated particulates section to most current version

Page No.	Section	Description of Changes
7-8	2.1 A.2	Updated visible emissions section to most current version
8	2.1 A.2.c	Visible emissions monitoring/recordkeeping/reporting requirements deleted for semiconductor manufacturing lines (ID Nos. ESMAN31, and ESMAN32)
	2.1 B.1.c	Visible emissions monitoring/recordkeeping/reporting requirements deleted for small tool parts bead blast system (ID No. B10)
10	2.1 D	• Added "emergency" to description of generator ID No. G1 • Deleted sulfur dioxide avoidance conditions for PSD from table
10-13	2.1 D.3	Revised 40 CFR 63 Subpart ZZZZ (RICE NESHAP) section to most current stipulation
14	2.1 E	Deleted sulfur dioxide avoidance conditions for PSD from table
15-17	2.1 E.3	Revised 40 CFR 60 Subpart IIII (Stationary Compression Ignition Internal Combustion Engines) section to most current stipulation
17	2.1 E.4	Added title of 40 CFR 63 Subpart ZZZZ (RICE NESHAP) to section heading
	2.1 F	Deleted sulfur dioxide avoidance conditions for PSD from table
17-19	2.1 F	Removed boilers ID Nos. B1 through B8 from this section
19	2.1 F.4	Revised 40 CFR 60 Subpart Dc (Small Industrial-Commercial-Institutional Steam Generating Units) section to most current stipulation
20	2.1 F.5	Removed "for Avoidance of" and added "MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY" to section heading
	2.1 F.5.d, e	Updated recordkeeping and reporting sections
22	2.1.H.2.c	Visible emissions monitoring/recordkeeping/reporting requirements deleted for wafer dicing center (ID No. ESWD2)
23-24	2.1 I.3.a	• Reformatted paragraph • Added "dry mechanical polishing of finished metals and formed products after plating or thermal spraying" to the list of processes • Added "mist" to description of control devices in table
24	2.1 I.3.b	Changed "facility" to "Permittee" where appropriate
	2.1 I.3.c	Created new paragraph c containing the list of management practices formerly in paragraph b; changed numbering within paragraph to Roman numerals.
24-25	2.1 I.3.d	Former paragraph c changed to paragraph d; changed numbering within paragraph to Roman numerals.

Page No.	Section	Description of Changes
25	2.1 I.3.d.ii	Changed "you have installed the control system" to "the control system has been installed"
	2.1 I.3.e, f	Former paragraph d changed to paragraph e; former paragraph e changed to paragraph f. Changed "facility" to "Permittee"
	2.1 I.3.f	Changed numbering within paragraph to Roman numerals
	2.1 I.3.g	Former paragraph f changed to paragraph g
	2.1 I.3.h	Former paragraph g changed to paragraph h. Changed numbering within paragraph to Roman numerals
26	2.2 A	Deleted sulfur dioxide avoidance conditions for PSD from table
27	2.2 A.3.c	Changed "Section 2.2 A.4.a" to "Section 2.2 A.3.a"
27-28	2.2 A.4	• Deleted sulfur dioxide avoidance conditions for PSD • Renumbered Section 2.2 A.5 (EMISSION RATES REQUIRING A PERMIT) as Section 2.2 A 4
28	2.2 A.4.c	Changed "Soluble chromate compounds (" in Emission Rates table to "Soluble chromate compounds as chromium (VI) equivalent"
29-30	2.2 B	Changed control device ID No. CDEB3 to CDAG1
	2.2 B.1	Added title of 40 CFR 63 Subpart BBBBB to section heading
31-40	3	Updated General Conditions to version 5.3 dated August 21, 2018

The following changes were made to the Title V Equipment Editor (TVEE):

- Added Source ID No. I-LA, Laser ablation tool
- Changed Control Device ID No. CDEB3, One constant stirred tank particulate abatement device, to CDAG1, One small packed bed particulate scrubber
- Changed Source ID Nos. for Nos. B1 through B3, One natural gas-fired boiler (3.5 million Btu per hour heat input) at 7907 Piedmont Triad Parkway to Source ID Nos. I-B1 through I-B3
- Changed Source ID Nos. B4 through B8, One natural gas-fired boiler (1.56 million Btu per hour heat input) at 7914 Piedmont Triad Parkway to Source ID Nos. I-B4 through I-B8
- Added Source ID No. I-CTC, Two-cell cooling tower at 7914 Piedmont Triad Parkway
- Added Source ID No. I-CTD Five-cell cooling tower at 7908 Piedmont Triad Parkway
- Added Source ID No. I-CTM, Single-cell cooling tower at 8220 Piedmont Triad Parkway
- Added Source ID Nos. I-GFUH2 through I-GFUH7, natural-gas fired heaters at 7907 Piedmont Triad Parkway (0.15 million Btu per hour heat input)

5. Description of Changes and Estimated Emissions

A. Add a laser ablation tool (ID No. I-LA) to the insignificant activities list.

15A NCAC 02Q .0503(8) defines an insignificant activity as "any activity whose emissions would not violate any applicable emissions standard and whose potential emission of particulate, sulfur dioxide, nitrogen oxides, volatile organic compounds, and carbon monoxide before air pollution control devices, are each no more than five tons per year (ton/yr) and whose potential emissions of hazardous air pollutants before air pollution control devices, are each below 1000 pounds per year (lb/yr)."

Uncontrolled particulate matter (PM) emissions from the laser ablation tool were determined to be 0.0338 ton/yr, well below the five ton/yr limit. These PM emissions would be controlled by air filters with 99 percent control efficiency. The laser ablation tool is used to cut epoxy on circuit boards, removing a mold resin that is 80 to 90 percent silica, and contains 500 ppm phenol before curing. The phenol would no longer be present in the resin after curing, when cutting would occur. Using a conservative assumption that all of the phenol is emitted, the emission rate would be 9.87×10^{-6} pounds per hour (lb/hr), or 4.33×10^{-5} ton/yr – significantly less than the toxic pollutant emission rate TPER of 0.024 lb/hr. Based on these emission quantities, the laser ablation tool can be classified as an insignificant activity.

B. *Remove the SO_2 limit and associated recordkeeping and reporting condition (Specific Condition 2.2 A.4) from the permit.*

Specific Condition 2.2 A.4 in the current permit allows Qorvo to avoid prevention of significant deterioration (PSD) requirements for sulfur dioxide (SO_2) as long as they can show that plant-wide SO_2 emissions are less than 250 tons per consecutive 12-month period. In this permit application, Qorvo provided updated potential-to-emit calculations to demonstrate their uncontrolled plant-wide SO2 emissions would be 480 pounds per year—less than one-half of a ton—because only ultra-low sulfur diesel fuel (15 parts per million sulfur content) is available for use at the facility. Based on these new emission estimates, they have requested that this avoidance condition be removed from the permit.

The table below compares emission estimates provided in the renewal application for combustion emission sources at the Qorvo facility to emission estimates for those same sources calculated using the DAQ emission estimation spreadsheets for fuel oil combustion (Rev. G, 11/05/12), natural gas combustion (Rev. N, 1/15/17), and internal combustion engines (Rev. J and S, 6/22/15). Combustion sources listed as insignificant sources were not included.

Source Description	Source ID No.	Emission Estimate, ton/yr (from Qorvo Application)	Emission Estimate, ton/yr (from DAQ Spreadsheets)
Natural Gas/No.2 Fuel Oil Boilers, 7908 Piedmont Triad Pkwy	ESB31, ESB32, ESB33 (16.33 mmBtu/hr each)	0.326	0.33
Diesel Emergency Generators, 7908 Piedmont Triad Pkwy	ESG31, ESG32, ESG33, and ESG34 (2200 kW each)	0.00625	0.06
Large Emergency Generators	ESG1 (2000 kW)	0.0109	0.06
	G1 (500 kW)		2.66
TOTAL		**0.343**	**3.11**

As shown, both estimates of SO_2 emissions are well below the plant-wide PSD avoidance condition limit of 250 tons per consecutive 12-month period. For this reason, the SO_2 avoidance condition will be removed from the permit. Continued compliance is expected.

C. *Move the five natural gas-fired boilers **(ID Nos. B4, B5, B6, B7, and B8)** at 7914 Piedmont Triad Parkway to the insignificant activities list based on their maximum firing rate of 1.56 million British thermal units per hour (mmBtu/hr), each.*
- *Move the three natural gas-fired boilers **(ID Nos. B1, B2, and B3)** at 7907 Piedmont Triad Parkway to the insignificant activities list based on their maximum firing rate of 3.5 mmBtu/hr, each.*

As stated in 15A NCAC 02Q .0503(8), a source can be considered insignificant if its uncontrolled emissions are less than five ton/yr of any criteria pollutant, or less than 1000 lb/yr of hazardous pollutant. The table below compares estimates of potential emissions for boiler B1 (maximum firing rate

of 3.5 mmBtu/hr) taken from the Qorvo application to estimates calculated with the DAQ spreadsheet for natural gas combustion (Rev N, 1/05/17).

Pollutant	Emission estimate (from Qorvo application)	Emission estimate (from DAQ spreadsheet)
Total HAP/TAP	435 lb/yr	56.6 lb/yr
Nitrogen oxides	1.49 ton/yr	1.5 ton/yr

As shown above, both emission estimates are below are less than five ton/yr of any criteria pollutant, or less than 1000 lb/yr of hazardous pollutant. Given that boilers B2 and B3 have the same maximum firing rate as boiler B1, and boilers B4 through B8 have lower firing rates than boiler B1, all eight of these boilers can be classified as insignificant sources of air pollution. Boilers B1 through B8 will be removed from Special Condition 2.1 F in the permit. Compliance is expected.

D. *Remove the monthly visible emissions monitoring and recordkeeping requirements for the following sources from the permit:*

- *Semiconductor manufacturing lines No.* ***ESMAN31*** *and* ***ESMAN32*** *with associated particulate abatement devices for ICP Etching (****ID Nos. CDEB3 through CDEB6)****, and acid gas controls scrubbers* ***(ID Nos. CD31, CD32, and/or CD33)*** *(Permit Specific Condition 2.1A.2),*
- *Small tool parts bead blast system* ***(ID No. B10)*** *with an integral cyclone, and associated cartridge filter (****ID No. CDB10****) (Permit Specific Condition 2.1.B.1)*
- *Wafer Dicing Center No. 2* ***(ID No. ESWD2)*** *with associated fabric filters* ***(ID Nos. CDWD2a and CDWD2c)****, HEPA filters* ***(ID Nos. CDWD2b and CDWD2d)****, and acid gas control scrubbers* ***(ID Nos. CD31, CD32 and CD33)*** *(Permit Specific Condition 2.1.H.2).*

Qorvo makes this request based on compliance history and the facility's historical records of monthly visible emission observations indicating that there are no visible emissions being emitted. Regarding Specific Condition 2.1.H.2, any particulates from the wafer dicing center are exhausted through fabric filters, HEPA filters, and acid gas scrubbers prior to being emitted. In addition, each scrubber is equipped with two re-circulation pumps for redundancy if one pump were to fail. Visible emissions are not likely to occur with this control system.

A discussion with the inspector from the Regional office (J. Hafner, 8/16/19) confirmed that no visible emissions have been observed from any of these sources. The inspector recommended removal of the monitoring and recordkeeping requirements for these sources, which has been done. Continued compliance is expected.

E. *Add three cooling towers at the Qorvo facility to the insignificant activities list.*

Qorvo has a two-cell cooling tower located at 7914 Piedmont Triad Parkway (I-CTC), a five-cell cooling tower at 7908 Piedmont Triad Parkway (I-CTD), and a single-cell cooling tower at 8220 Piedmont Triad Parkway (I-CTM). They have requested these induced draft cooling towers be added to the insignificant activities list in the permit.

The towers emit steam, which contains particulates from the minerals in the water. If the flow rate of water supplied to the towers is 1,080 gallons per minute (gal/min), and the drift loss (per cent of water lost to the atmosphere) is 0.005%, the amount of water emitted is (.005%) x 1,080 gal/min = 0.05 gal/min. Using conductivity measurements of the cooling tower water to project total dissolved solids (TDS), the TDS concentration in the cooling tower water supply is 800 parts per million (ppm).

The total suspended particulate (TSP) emission rate in pounds per hour (lb/hr) would be calculated as follows:

TSP (lb/hr) = emission rate (gal/min) * 60 min/hr * 8.34 lb/gal water * pounds TDS/10^6 pounds water

= 0.05 gal/min * 60 min/hr * 8.34 lb/gal water * 800 lb /10^6 lb = 0.02 lb/hr

In a worst case scenario, assuming TSP = PM_{10}, and that every cooling tower cell at the facility is in use 24 hours a day, 365 days per year, as shown in the following table, the combined emissions from the cooling towers would not exceed one ton per year.

Cooling Tower	Number of cells	PM_{10} emissions per cell, lb/yr (hourly rate * 8,760 hr/yr)	PM_{10} emissions per tower, lb/yr (No. of cells * annual rate)	PM_{10} emissions per tower, ton/yr
I-CTC	2	175.2	350.4	0.2
I-CTD	5	175.2	876	0.4
I-CTM	1	175.2	175.2	0.1
Total			**1401.6**	**0.7**

Because only 40% of dissolved solids will coalesce to PM10, annual PM10 emissions from the towers will be significantly less than estimated above. In addition, at the present time only one cell at each cooling tower cells operates year-round. At tower I-CTC, one additional cell runs nine months per year. At I-CTD, a second cell runs nine months per year, and a third is used less than 400 hours a year. Based on these emission quantities, the cooling towers can be classified as an insignificant activity that should have no significant impact on overall emissions at the Qorvo facility.

F. *Revise permit conditions from NESHAP 40 CFR 63 Subpart ZZZZ and NSPS 40 CFR 60 Subpart IIII to be in accord with vacatur provisions as noted in EPA memo dated April 15, 2016.*

Section 7.A of this application review discusses this issue in detail.

G. *Replace existing control device ID No. CDEB3 (a constant stirred tank particulate abatement device) with control device ID No. CDAG1 (a compact packed bed scrubber).*

The existing particulate abatement device (manufactured by Ebara) has reached the end of its useful life, and is no longer manufactured. CDEB3 is one of three particulate abatement devices used to remove particulates emitted from the etching process. These point-of-use scrubbers are used to react the boric acid with water where it readily dissolves and is removed, thereby preventing the clogging of ductwork. They are not required to achieve compliance with any emissions standard. Qorvo has elected to replace the existing device with a state-of-the-art compact packed bed scrubber (CDAG1) on July 1, 2019. While Qorvo acknowledges the new scrubber will not provide ancillary control of arsenic emissions like the CDEB3 unit that has already been decommissioned, arsenic and other facility air toxic emissions have already been addressed through limits currently in the permit. These limits will remain unchanged by the renewal. Continued compliance is expected.

H. *Add six natural-gas fired heaters at 7907 Piedmont Triad Parkway (Source ID Nos. I-GFUH2 through I-GFUH7) to the insignificant activities list in the permit.*

Qorvo has decided to take over building space in the 7907 Piedmont Triad Parkway building formerly occupied by a co-lessee, and to use the vacated space as additional warehouse space. The vacated space

has six identical natural gas-fired space heaters which were installed in 1992, each with a heat input of 0.15 million Btu/hr.

Using the spreadsheet for natural gas combustion (Rev N., 1/05/2007), emissions from these space heaters was estimated assuming the heaters are used 24 hours per day for six months of the year, and that 1 cubic foot of natural gas is equivalent to 1,027 Btu. Using these values, and the heat input for the space heaters, the following yearly fuel usage in cubic feet (cf) was calculated:

$$0.15 \times 10^6 \frac{\text{Btu}}{\text{hr}} \times \frac{24\ \text{hr}}{\text{day}} \times \frac{180\ \text{day}}{\text{yr}} \times \frac{1\ \text{cf}}{1027\ \text{Btu}} = 630{,}964\ \text{cf/yr} \quad \text{or} \quad 0.631\ \text{million cf/yr}$$

Using these inputs into the spreadsheet, estimated annual emissions for all six space heaters combined were well below five ton/yr for any criteria pollutant, or 1000 lb/yr for any hazardous pollutant. These heaters are therefore exempted under 15A NCAC 02Q .0503(8). They will be added to the insignificant activities list, and assigned source ID Nos. I-GFUH2 through I-GFUH7, respectively. As insignificant activities, these sources should have no significant impact on overall emissions at the Qorvo facility.

I. Replace existing constant stirred tank particulate abatement device (ID No. CDEB3) with a new small packed bed particulate scrubber (ID No. CDAG1).

The existing constant stirred tank scrubber unit was used to control emissions from ICP etch tooling, a process that uses boron trichloride (BCL3). The BCL3 breaks down to form boric acid, which plugs up the exhaust ductwork. The scrubber is used to dissolve the boric acid with water so it can be removed before it clogs the ductwork. The existing scrubber CBEG3, a control device which is not required to meet any emissions standard, is no longer sold or supported by its manufacturer (Ebara), and is approaching the end of its service life. Qorvo has asked to replace the existing unit with an Airgard small packed bed scrubber, CDAG1. This scrubber replacement will have no impact on emissions from the Qorvo facility. Continued compliance is expected.

6. Regulatory Review

Qorvo is subject to the following regulations from Title 15A of the North Carolina Administrative Code:

- 02D .0503: Particulates from Fuel Burning Indirect Heat Exchangers
- 02D .0515: Particulates from Miscellaneous Industrial Processes
- 02D .0516: Sulfur Dioxide from Combustion Sources
- 02D .0521: Control of Visible Emissions
- 02D .0524: New Source Performance Standards (40 CFR Part 60 Subparts Dc and IIII)
- 02D .0541: Control of Emissions from Abrasive Blasting
- 02D .1100: Control of Toxic Air Pollutants
- 02D .1111: Maximum Achievable Control Technology (40 CFR Part 63 Subpart ZZZZ)
- 02D .1806: Control and Prohibition of Odorous Emissions
- 02Q .0317: Avoidance Conditions (for PSD, HAP-Major, and 40 CFR Part 63 Subpart JJJJJJ)
- 02Q .0711: Emission Rates Requiring a Permit

An extensive review for each applicable regulation is not included in this document, as the facility's status with respect to these regulations has not changed. A number of sources at the facility formerly subject to these standards have been reclassified as insignificant sources of emissions; these have been discussed above in Section 5. For more information regarding NSPS, NESHAP, and avoidance conditions, see Sections 7 and 8. The permit has been updated to reflect the most current stipulations for all applicable regulations.

Rule 02D .0958, "Work Practices for Sources of Volatile Organic Compounds, no longer applies in Guilford County, as this county is not listed in 02D .0902, “Applicability.” Therefore, 02D .0958 has been removed from the above list of rules.

7. NESHAPS/MACT/GACT

Qorvo is subject to the following MACT/GACT requirements:

A. *40 CFR 63 Subpart ZZZZ, National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines*

This regulation applies to five of the emergency generators at the facility (**ID Nos. ESG1, ESG31, ESG32, ESG33, and G1)**.

On May 1, 2015, the U.S. Court of Appeals for the D.C. Circuit issued a decision that vacated paragraphs from the New Source Performance Standards (NSPS) for Stationary Compression Ignition and Spark Ignition Internal Combustion Engines (40 CFR part 60 subparts IIII and JJJJ) and the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Stationary Reciprocating Internal Combustion Engines (RICE) (40 CFR part 63 subpart ZZZZ). These vacated paragraphs (40 CFR 60.4211(f)(2)(ii)-(iii), 40 CFR 60.4243(d)(2)(ii)-(iii), and 40 CFR 63.6640(f)(2)(ii)-(iii)) specified that emergency engines may operate for a limited number of hours per year in two situations: (1) emergency demand response when the Reliability Coordinator has declared an Energy Emergency Alert Level 2, and (2) when there is a deviation of voltage or frequency of five percent or greater below standard voltage or frequency. The U.S. EPA issued guidance on April 15, 2016 on implementing these rules following the vacatur by the Court of Appeals.

In keeping with the guidance issued by the EPA, requirements stipulated by the vacated paragraphs have been removed from Specific Conditions 2.1 D.3.m and 2.1 E.3.i in the permit. Additional revisions to Subpart ZZZZ permit stipulations have been made in accordance with 15A NCAC 02Q .0317; this is explained in further detail in paragraph 7C below.

Continued compliance with this rule is expected.

B. *Avoidance of 40 CFR 63 Subpart JJJJJJ, National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources*

This regulation applies to boilers that fire non-gaseous fuel at HAP-Minor facilities – the three natural gas/No. 2 fuel oil-fired boilers at this facility (ID Nos. ESB31 through ESB33).

According to the definitions in Subpart JJJJJJ, boilers that only fire liquid fuel during periods of natural gas curtailment and maintenance are not considered part of the "oil subcategory". Qorvo has accepted a permit stipulation to only fire fuel oil during those times to avoid applicability of this regulation. Qorvo must keep records of when fuel oil is burned in the boilers, and limit periodic testing of liquid fuel to 48 hours per year.

Additional revisions to Subpart JJJJJJ permit stipulations have been made in accordance with 15A NCAC 02Q .0317. This is explained in further detail in paragraph 7C below.

Continued compliance with this rule is expected.

C. Avoidance of HAP-Major Status/Subpart BBBBB, National Emission Standards for Hazardous Air Pollutants for Semiconductor Manufacturing

To avoid being subject to this regulation, Qorvo accepted an avoidance condition in their permit under 15A NCAC 02Q .0317 to limit annual emissions to less than 10 tons of any individual HAP and 25 tons of combined HAPs. Qorvo must keep monthly records demonstrating continued compliance with the emission limits, and submit summary reports semi-annually.

During this application review, DAQ recognized that 02Q .0317 ensures minor status to avoid applicability of all major MACT—including Subparts ZZZZ (RICE—see section 7A of this review) and JJJJJJ (boilers – see section 7B of this review). Accordingly, the stipulations in the permit pertaining to these MACT rules (for RICE, Specific Conditions 2.1 D.3, 2.1 E.4; for boilers, Specific Conditions 2.1 F.5) have been revised to reference the requirements applicable to an area source.

Continued compliance is expected.

D. 40 CFR 63 Subpart WWWWWW, National Emission Standards for Hazardous Air Pollutants: Area Source Standards for Plating and Polishing Operations

This regulation applies to area sources that conduct metal plating and polishing activities and that use or emit compounds of one or more plating and policing metal HAP. Qorvo operates two nickel plating tanks (ID Nos. ES-PL1c and ES-PL1d), and two copper sulfate and nickel sulfate plating tanks (ES-PL2a and ES-PL2b). The tanks are controlled with mesh pad mist eliminators. Qorvo must ensure these control devices are operated in accordance with the manufacturer's instructions, implement the management practices specified by the rule, and mating records documenting compliance. No updates to Subpart WWWWWW have been made since the last permit was issued. Continued compliance is expected.

8. New Source Performance Standards (NSPS)

Qorvo is subject to the following NSPS:

A. 40 CFR Part 60, Subpart IIII: Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

A 2,200 kW No. 2 fuel oil-fired emergency generator (ID No. ESG34) at the facility is subject to Subpart IIII. The court ruling and EPA guidance memorandum discussed in Section 7.A above had identical impacts on this NSPS. Accordingly, Specific Condition 2.2 E.3.i(2) of the permit has been revised, deleting language that allowed emergency engines to operate for a limited number of hours for (1) emergency demand response when the Reliability Coordinator has declared an Energy Emergency Alert Level 2, or (2) when there is a deviation of voltage or frequency of five percent or greater below standard voltage or frequency. Continued compliance is expected.

B. 40 CFR Part 60, Subpart Dc: Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units

Three natural gas/No. 2 fuel oil-fired boilers (ID Nos. ESB31 through ESB33) at the facility are subject to subpart Dc. Based on the size and fuel types of the boilers at the facility, this NSPS requires Qorvo to limit the sulfur content of fuel oil to 0.5% or less, keep records of sulfur content and overall fuel usage, and to submit semi-annual reports. Since no changes to NSPS Subpart Dc have been made since the last permit was issued, the permit stipulation remains unchanged. Continued compliance is expected.

9. New Source Review (NSR)/Prevention of Significant Deterioration (PSD)

Qorvo has accepted avoidance conditions in their permit to avoid applicability of PSD requirements for volatile organic compounds and sulfur dioxide. They must emit less than 250 tons of each criteria pollutant per consecutive 12-month period. Qorvo must calculate total VOC emissions monthly, keep records of the amount of fuel used and the sulfur content to calculate sulfur dioxide emissions, and submit semi-annual reports. Continued compliance is expected.

10. Risk Management Program (Clean Air Act, Section 112(r))

40 CFR Part 68 establishes requirements for stationary sources that hold more than threshold quantities of regulated substances to develop a risk management plan (RMP), in accordance with Section 112(r) of the Clean Air Act. The RMP identifies the potential effects of a chemical accident, steps the facility is taking to prevent an accident, and emergency response procedures if an accident occurs.

The Qorvo facility does not appear to store any regulated substances necessitating a RMP. This permit renewal does not affect this status.

11. Compliance Assured Monitoring (CAM)

40 CFR Part 64 establishes requirements for compliance assurance monitoring (CAM). This rule applies to any pollutant specific unit that meets the following three conditions:

- it is subject to any non-exempt (e.g., Section 111 or Section 112 standard prior to pre-November 15, 1990) emission limitation or standard for the applicable regulated pollutant.
- it uses any control device to achieve compliance with any such emission limitation or standard.
- its pre-control potential emission rate exceeds any of the major source thresholds.

CAM was determined in a preceding permit review (December 29, 2014) to be non-applicable to the Qorvo facility. This permit renewal does not affect that status.

12. Facility-wide Air Toxics

The Qorvo facility is subject to emission limits for arsenic, chlorine, and sulfuric acid in accordance with 15A NCAC 02D .1100, "Control of Toxic Air Pollutants". These emission limits were established as a facility-wide worst-case single stack modeling demonstration. To ensure compliance with these limits, Qorvo is required to comply with operating restrictions for wafer dicing center No. 2 **(ID No ESWD2)**. The operating restrictions describe the control requirements for this source. In addition to the operating restrictions, Qorvo is required to conduct proper inspection and maintenance activities on the installed control devices. This permit renewal does not affect this status.

The permit lists several NC toxic air pollutants (TAPs) and their respective toxic permit emission rates (TPERs) as established in 15A NCAC 02Q .0711, "Emission Rates Requiring a Permit". Qorvo has demonstrated its facility-wide actual emissions do not exceed the TPERs. The permit requires Qorvo to operate and maintain the facility so that emissions of any listed TAPs from the facility, including fugitive emissions, will not exceed the TPERs; and to maintain records that demonstrate compliance with each TPER. Based on the most recent inspection, Qorvo has been complying with this regulation. Continued compliance will be determined during subsequent inspections.

13. Facility Emissions Review

There is no change in Title V potential emissions for this renewal. Actual emissions for the years 2013 through 2017 documented in the emission inventories are presented on the front page of this review.

14. Compliance Status

The facility was last inspected on June 6, 2018 by Taylor Hartsfield and George Williams of the WSRO. The company appeared to be in compliance with all applicable requirements at that time. There have been no Notices of Violation or Notices of Deficiency issued to Qorvo since the last permit renewal.

15. Public Notice/EPA and Affected State(s) Review

A notice of the DRAFT Title V Permit shall be made pursuant to 15A NCAC 02Q .0521. The notice will provide for a 30-day comment period, with an opportunity for a public hearing. Consistent with 15A NCAC 02Q .0525, the EPA will have a concurrent 45-day review period. Copies of the public notice shall be sent to persons on the Title V mailing list and EPA. Pursuant to 15A NCAC 02Q .0522, a copy of each permit application, each proposed permit and each final permit shall be provided to EPA. Also, pursuant to 02Q .0522, a notice of the DRAFT Title V Permit shall be provided to each affected State at or before the time notice is provided to the public under 02Q .0521 above. Virginia is an affected state within 50 miles of the facility, and Forsyth County is an affected local air quality management program.

14. Other Regulatory Considerations

A P.E. seal was not required for this permit renewal.

A zoning consistency determination not required for this permit renewal.

No permit fee was required for this permit renewal.

15. Recommendations

The permit application for Qorvo US, Inc. located at 7914 Piedmont Triad Parkway, 7908 Piedmont Triad Parkway, 7628 Thorndike Road, 7907 Piedmont Triad Parkway, and 8220 Piedmont Triad Parkway in Greensboro, Guilford County, North Carolina has been reviewed by DAQ to determine compliance with all procedures and requirements. DAQ has determined that this facility is complying or will achieve compliance, as specified in the permit, with all requirements that are applicable to the affected sources. The DAQ recommends the issuance of Air Permit No. 08409T19.